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Litter assessment at the Sakumono and La Pleasure coastal areas, Ghana

OBED ADJEI, ANGELA MANEKUOR LAMPTEY♥
Department of Marine and Fisheries Sciences, University of Ghana. Legon Boundary, Accra, Ghana. Tel.: +233-30-221-3850,
♥email: amlamptey@ug.edu.gh

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Abstract. *Adjei O, Lamptey AM. 2021. Litter assessment at the Sakumono and La Pleasure coastal areas, Ghana. Indo Pac J Ocean Life 5: 83-91.* Ghana has a difficult time managing waste, especially in the cities. The situation is even made worse in coastal urban areas by population growth. When the rains fall and wash the solid wastes downstream, most waste produced and lost inland ends up in the coastal and marine environment. In addition, revelers who use the areas for entertainment and tourism also contribute to the waste created. The Sakumono and La Pleasure Beaches in the Greater Accra Region served as the sites for this study. This study's primary goal was to assess how much waste was on the beaches at the two locations. The study made use of a transect measuring 1,000 m^2. A total of 2,697 litter items were collected from the two beaches. During the survey, 50.07 kg from both sites comprised the entire weight of the litter collected. Comparatively, the amount of waste collected from La Pleasure was 18.28 kg, which accounted for 36.51% of the total amount of litter surveyed. The amount of trash collected from Sakumono Beach was 31.79 kg, representing 63.49% of the total litter surveyed. Plants were discovered to be the most prevalent material by weight and number. Plastics accounted for 72.56% of the total composition for both beaches, or 1,975 items, and 65.53% of the total composition, or 32.81 kg, respectively. In comparison to La Pleasure Beach, Sakumono Beach was found to be more littered. An alpha value of 0.05 (a p-value = 0.02) indicated this was significant. Ongoing monitoring, intensive education, and sensible policy initiatives are still essential to address the beach litter problem along Ghana's coasts.

Keywords: Coastal, plastic, urban areas, waste management

INTRODUCTION

Large inland lakes and other areas that serve as an interface or transition between land and water are considered coastal areas (Masalu 2000). Coastal regions house more than 60% of the world's population despite making up only 10% of the planet's land area (Lakshmi and Rajagopalan, 2000). The coastal area and its resources are under great pressure due to the growing populations in coastal areas. Many of these activities produce large amounts of waste and litter in coastal areas. Beach debris is an issue worldwide (Derraik 2002; Gregory and Andrady 2003; Ivar do Sul and Costa 2007; Lie et al. 2018). According to the UNEP (2009), marine debris or marine litter is any durable, manufactured, or processed solid object dumped, disposed of, or left outside in the Great Lakes. They also include items created or used by people and intentionally or unintentionally lost to the ocean, including those carried to the ocean by rivers, drainage systems, sewage systems, or even the wind (Galgani et al. 2010).

The NOAA (2007) states that common household items, commercial goods, lost or abandoned fishing gear, and industrial products qualify as marine debris or litter. Introducing significant amounts of litter into the marine environment could also result from natural disasters like floods, landslides, hurricanes, and tidal waves (Thompson et al. 2005). Marine debris can be found on all kinds of beaches. They can be found on both remote and popular recreational beaches worldwide (Jambeck et al. 2001; Sheavly 2007). Despite regional, national, and international efforts, there are signs that the marine litter issue is only getting worse (UNEP 2016). According to Sheavly (2007), UNEP (2009), NOAA (2010), and World Ocean Review (2010), marine debris is not just a problem for the environment, but it is also bad for business and aesthetics.

Depending on where it enters the water, marine litter can be classified as either ocean-based or land-based (NOAA 2007a; Sheavly 2007; UNEP 2016). According to Thompson et al. (2009), the main ocean-based sources include fishing, shipping, offshore mining and extraction, legal and illicit dumping at sea, abandoned, lost, or discarded fishing gear, and natural catastrophic events. Some significant terrestrial or land-based sources include industrial discharges, waste from dumps, fishing activities, tourism, discharge, and storm-related natural events (Allsopp et al. 2006; Mouat et al. 2010). According to estimates, land-based sources account for about 80% of marine debris pollution worldwide, with ocean-based sources accounting for the remaining 20% (CMC 2000; World Ocean Review 2010). As a result of their inability to be linked to a single or unique source, other items are categorized as general source items (Jambeck et al. 2015). Other elements, such as ocean current patterns, tides, climate, and proximity to urban areas, landfills, industrial and recreational areas, shipping lanes, and commercial fishing grounds, affect the kind and quantity of marine debris found in open ocean areas or gathered along beaches and the ocean (UNEP 2016). Beach litter that accumulates along scenic shorelines and waterways detracts from those beaches' aesthetic appeal and satisfaction and harms tourism (Rockefeller 2003). Marine debris is unsightly and dangerous to other marine organisms and equipment. Discarded fishing equipment, ropes, and plastic bags can get caught around boat propellers and cause damage or get sucked into the boat's engines (UNEP 2009). Medical waste and other used medical equipment left around carelessly on beaches can carry diseases, even as broken glasses and other sharp objects pose obvious risks for beachgoers who may be barefooted (NOAA 2010). Beach debris can also destroy an organism's habitat by affecting water quality and physically harming delicate ecosystems. The effects and impacts of marine litter also extend to seagrass beds, coral reefs, and the benthic species that inhabit them. According to NOAA (2010), marine biodiversity may also suffer from marine litter. Numerous species unintentionally consume the waste after mistaking it for food. Discarded fishing nets, gear, lines, and other types of litter can entangle marine organisms, causing harm or even death (Sheavly 2007).

About 550 km of Ghana's coastline, which faces the Gulf of Guinea, is a very productive and long fishing line (EPA 2012). The country's abundant natural resources, which have a significant economic benefit, represent its productive nature (Amlalo 2007). According to Nunoo and Quayson (2003), plastics make up the majority of litter, a trend supported by several international studies (UNEP 1990; Topping et al. 1994; Hoagland and Kitte-Powell 1997; CMC 2000; UNEP 2009).

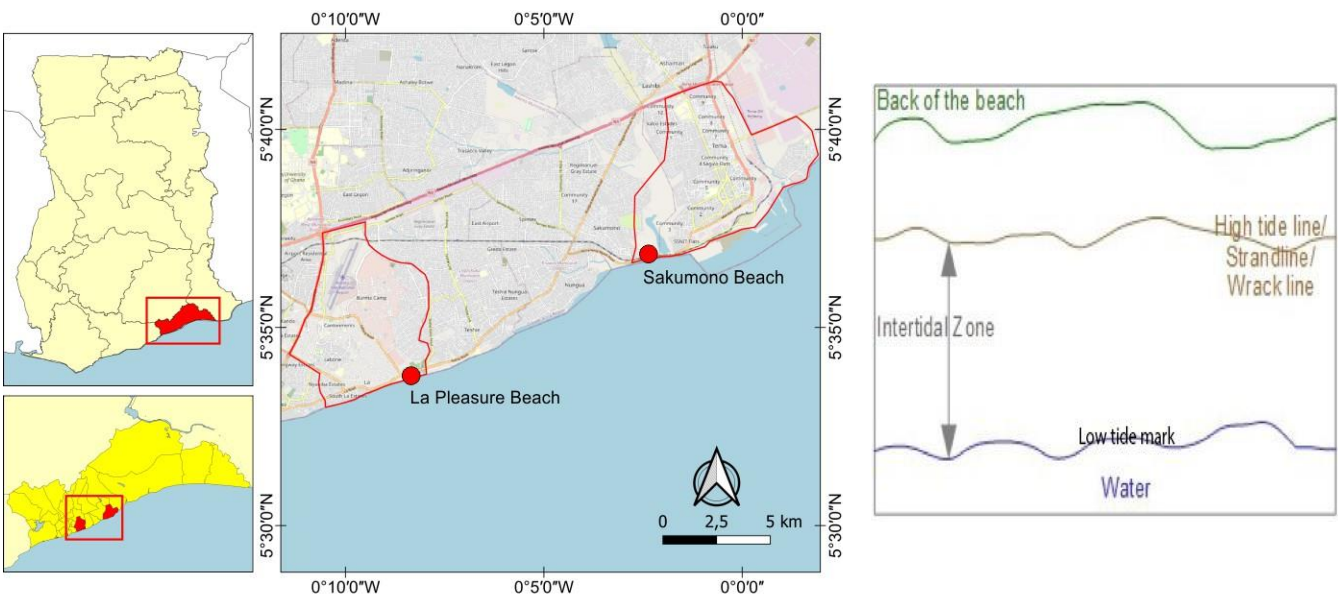
This study's main objective is to evaluate the amount of litter on the beaches at Sakumono and La Pleasure. The specific objectives are (i) Identifying the sources of litter at Sakumono and La Pleasure Beaches is the first of the specific goals. (ii) Analyze the amount and composition of the beach debris at Sakumono and La Pleasure Beaches. (iii) Assess the spatial variation in the amount of trash at Sakumono and La Pleasure Beaches.

MATERIALS AND METHODS

Study area

Two beaches in Ghana, Sakumono Beach, and La Pleasure Beach, were chosen for this study (Figure 1). About 12 kilometers separate the two beaches. Apart from these two beaches fulfilling the criteria for beach monitoring mentioned earlier (Opfer et al. 2012), they were chosen because La Pleasure Beach is a managed beach and Sakumono is a free and open beach. Therefore, an area of about 550 meters separates the two beaches.

People from the Sakumono township use the Tema Metropolis' Sakumono Beach as a place to land their catch of fish. Small-scale, artisanal farming and fishing are the main livelihoods of the Sakumono people. Sakumono Beach is close to the Sakumo II Lagoon, a Ramsar site, because of the wide variety of bird species it supports (Nunoo and Quayson, 2003). The sandy Sakumono Beach, guarded by a sea defense structure, is a popular destination for tourists from near and far. The Regional Maritime University is located on the beach's right side, and the Tema Port is on its left. Sakumono Beach is a low-lying stretch of sand with a slight incline in Accra's semi-arid coastal region. The beach has fine to coarse sand grains and receives an 800 mm average of rain annually over two rainy seasons.



A B

Figure 1. Map of Ghana showing study sites at Sakumono Beach and La Pleasure Beach. B. Diagram showing water level for sampling

In the La Dade-Kotopon Metropolis, the La Pleasure Beach is also situated at La Pleasure, off the Accra-Teshie/Nungua Road. The beach is one of Accra's busiest beaches and receives both domestic and international visitors every day of the week (Tsagbey et al. 2009). La Pleasure Beach is a sandy beach with fine to coarse sand grains; just like Sakumono Beach, La Pleasure Beach has a moderate slope.

The Greater Accra area includes both beaches. However, the Greater Accra region is the smallest, with a total land area of 3,245 km^2 and a population of 4,010,054, or 16.3% of Ghana's population (GSS, 2014). The coastline of the Greater Accra area, which stretches from Kokrobite in the west to Ada in the east, is about 225 km long.

As Sakumono is an open-access beach with unrestricted entry, these two beaches were chosen for the survey. Therefore, entering Sakumono beach is free, and there are no restrictions on what revelers can bring onto the beach. Contrarily, entry to La Pleasure Beach is more expensive and has more restrictions.

Data collection and analysis

A week before the survey began, a preliminary survey was conducted at the two beaches to pick the stations and get a sense of the beaches. During the preliminary survey, the two beaches were divided into five surveying transects measuring 100 x 10 m (1,000 m2). The Garmin Etrex 10 GPS was used to georeference the points. The coordinates were recorded and added to the GPS as entry points every 100 meters. This was done to act as a sampling frame for random selection during each visit. Furthermore, to correspond with the two beaches surveyed, the 100 x 10 m transects were designated La1-La5 and Sak1-Sak5. The edge of the transect was made to start at the low tide mark and follow the shoreline. The preliminary survey was also used to clean the beaches of any debris that had already accumulated there.

From January to April 2019, on the same day (Thursday), the beaches were surveyed twice a month at low tide, typically between 0 m and 0 m tidal levels. A 1,000 m^2 transect at each beach was randomly chosen for surveying during each survey event. Every transect had an equal chance of being chosen because pieces of paper with the codes for the different transects were folded. The transect's entire litter was gathered into trash bags with labels and taken outside for sorting and weighing. Hands were protected by latex gloves while selecting the litter. Any litter sticking out of the sand was carefully removed; if it was torn in the removal process, it was disregarded. That was done to ensure no litter within transect was missed and to avoid those that were deeply buried. Also, to prevent the phenomenon where a portion of the litter is buried and might not be accounted

Laboratory analysis

The litter was divided into distinguishable groups in the laboratory after sorting and arranging it. The litter was air-dried before being counted and electronically weighed to the nearest kilogram. This was done to obtain the litter's actual weight and remove as much sand and water as possible. Each bag was weighed before the contents were sorted and categorized following the Master List of categories in the guidance document (TGML/JRC) (Galgani et al. 2013b). The basic material types are as follows, with a total of thirty-nine (39) subcategories: (i) plastic, (ii) metal, (iii) rubber, (iv) glass/ceramics, (v) natural products, and (vi) miscellaneous. The litter was further categorized as either ocean-based or land-based based on the classification by Barr (2000).

Data analysis

The checklists were converted to an electronic format (Excel 2019, Microsoft) to calculate statistical parameters and weight percentages and to register the count of all items across all beaches. Then to perform a t-test and Analysis of Variance (ANOVA) on the data were to examine if there were any significant differences between the two beaches' litter.

RESULTS AND DISCUSSION

Results

A total of 2,697 items were gathered from the Sakumono and La Beaches throughout the study (Table 1). The combined weight of the litter from both sites during the survey was 50.07 kg (Table 2). While 18.28 kg of litter was collected from La Pleasure, it comprised 36.51% of the total amount of litter surveyed. The weight of litter collected from Sakumono Beach was 31.79 kg, which accounts for 63.49% of the total weight of the litter surveyed.

Sakumono had an average of 209 litter per week, with a mean weight of 3.97 kg and an average litter size of 2.86 kg. The average number of litter per week at La Pleasure Beach was 129, the average weight per week was 2.28 kg, and the average weight per week was 0.92 kg (Table 3).

Plastics were found to be the most abundant in number and weight. For both beaches, plastics comprised 65.53% (Figure 2) by weight at 32.81 kg and 72.56% (Figure 3) composition by number or quantity at 1,975 items.

At the various beaches, this trend of composition remained constant. Plastics were the most prevalent material at Sakumono in terms of weight (Figure 4) and number (Figure 5), each at 67%. Plastics were found to be the most prevalent type of litter at La Pleasure Beach, both in terms of weight and quantity (Figures 6 and 7).

By numbers, water sachets were the most abundant in terms of plastics (Figure 8). By numbers, the water sachets made up 22% of the plastics collected from both beaches (Figure 10). Although water sachets were abundant in numbers, toys weighed far more than them (Figure 9). Toys made up about 39% of the total weight of plastics (Figure 11). Regarding numbers, toys were the least, at only 13 (Figure 8). Twenty-five (25) of the thirty-five (35) litter types collected during the survey were identified as land-based marine litter, with only three (3) litter types identified as ocean-based (Table 4).

Table 1. List of litter items and numbers for both beaches

Item	Number	% Number
Plastics		
Bottles	282	10.4560623
Cutlery	67	2.48424175
Cigarette lighters	19	0.70448647
Cigarette butts	205	7.60103819
Styrofoam	160	5.93251761
Cups	20	0.7415647
Water sachet	424	15.7211717
Bags	320	11.8650352
Caps/lids	125	4.63477938
Toys	13	0.48201706
Synthetic rope	65	2.41008528
Fishing net	14	0.51909529
Strapping bands	17	0.63033
Crates/containers	23	0.85279941
Diapers	34	1.26065999
Sanitary towel/tampon	32	1.18650352
Straws	137	5.07971821
Metals		
Cans	87	3.22580645
Other pieces of metals	23	0.85279941
Crown corks	198	7.34149055
Rubber		
Balloons	46	1.70559881
Slippers	31	1.14942529
Condoms	56	2.07638116
Gloves	2	0.07415647
Tires	4	0.14831294
Pieces of foam	30	1.11234705
Glass/ceramics		
Bottle	34	1.26065999
Pieces	32	1.18650352
Natural products		
Processed wood	14	0.51909529
Rope	15	0.55617353
Paper/cardboard	32	1.18650352
Juice carton	94	3.4853541
Miscellaneous		
Clothing/rags	27	1.00111235
Shoes	12	0.44493882
Bags	3	0.11123471
Total	**2697**	**100**

Table 2. List of litter items and weights for both beaches

Item	Weight (kg)	% Weight
Plastics		
Bottles	2.45	4.89981385
Cutlery	0.24	0.48171317
Cigarette lighters	0.00	0.00796864
Cigarette butts	0.05	0.09007158
Styrofoam	0.85	1.69358529
Cups	0.12	0.2396583
Water sachet	4.03	8.04453011
Bags	1.28	2.55635515
Caps/lids	0.03	0.04992881
Toys	12.70	25.3658334
Synthetic rope	4.49	8.97021027
Fishing net	3.18	6.35533856
Strapping bands	0.02	0.03734675
Crates/containers	0.28	0.55121408
Diapers	2.34	4.66494872
Sanitary towel/tampon	0.74	1.46990421
Straws	0.03	0.05472198
Metals		
Cans	2.18	4.3438066
Other pieces of metals	1.24	2.48046336
Crown corks	0.26	0.51406704
Rubber		
Balloons	0.01	0.0183738
Slippers	0.19	0.37147036
Condoms	0.02	0.04473622
Gloves	0.00	0.00119829
Tires	4.30	8.58775558
Pieces of foam	0.18	0.35948744
Glass/ceramics		
Bottle	2.04	4.07419102
Pieces	1.60	3.19544394
Natural products		
Processed wood	0.00	0
Rope	0.00	0
Paper/cardboard	0.12	0.23646285
Juice carton	1.30	2.59070617
Miscellaneous		
Clothing/rags	1.03	2.04907842
Shoes	0.23	0.46493709
Bags	2.57	5.13467897
Total	**50.07**	**100**

Table 3. Mean weekly weights and number of litter for both beaches

Beach	Mean weekly weight (kg)	Mean weekly number
Sakumono	3.97 ± 2.86	209 ± 92.66
La Pleasure	2.28 ± 0.92	129 ± 30.63

Table 4. Sources of litter items (Barr 2000)

Sources	Types
Land-Based	Plastic Bottles, Straws (plastic), Plastic bags, caps/lids, Glass bottles, Water sachets, Balloons, Metal cans, Cigarette packaging/ wrappers, Crown corks, Styrofoam packs, plastic cutlery, cigarettes butts, shoes, Clothing/textile, condoms, diapers, Toys, Plastic cups, rubber slippers, Bags, sanitary towels/tampons, Newspaper/Magazine pieces, juice cartons.
Ocean/Waterway-Based	Fishing net, Rope, Strapping bands.
General	Nails, Cardboard, Glass, Metal, Plastic containers, Styrofoam, Pieces of foam, and Car tires.

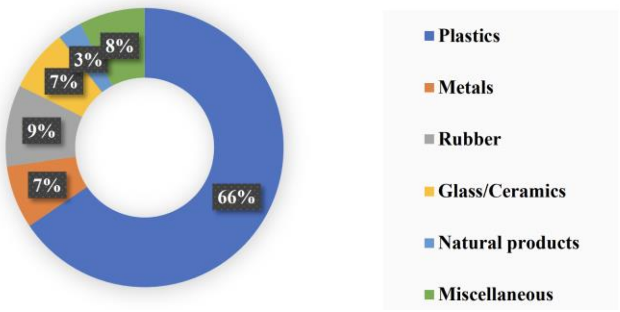


Figure 2. Composition of total litter by weight at both beaches

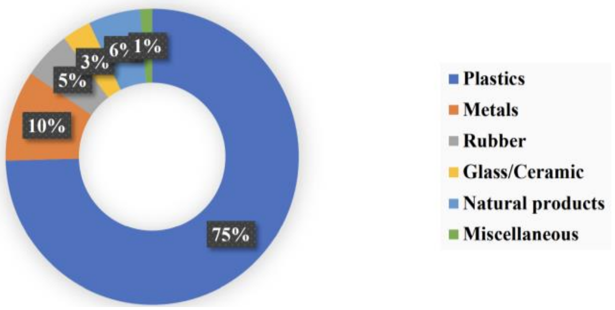


Figure 5. Composition by number of litter at Sakumono

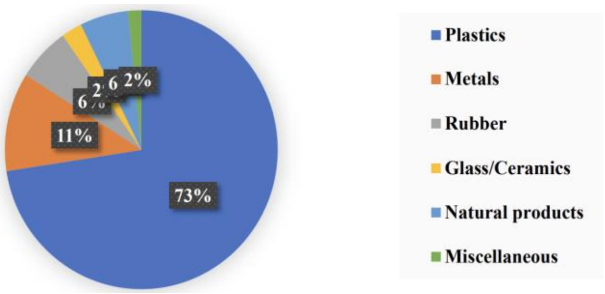


Figure 3. Composition of total litter by number at both beaches

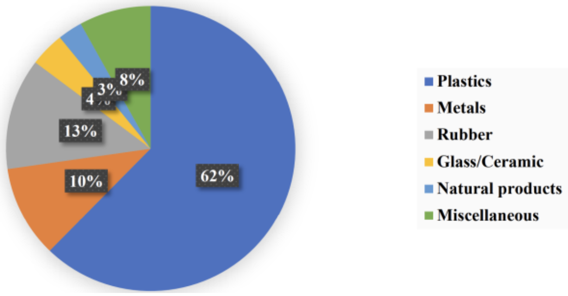


Figure 6. Composition by weight of litter at La, Ghana

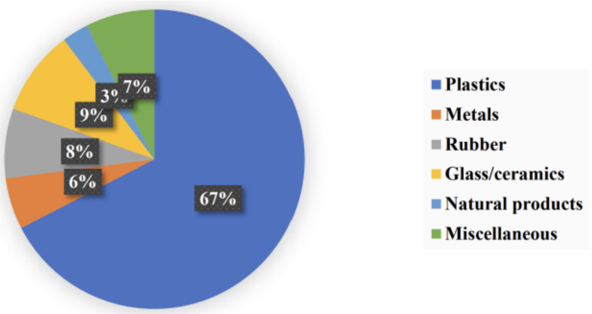


Figure 4. Composition by weight of litter at Sakumono, Ghana

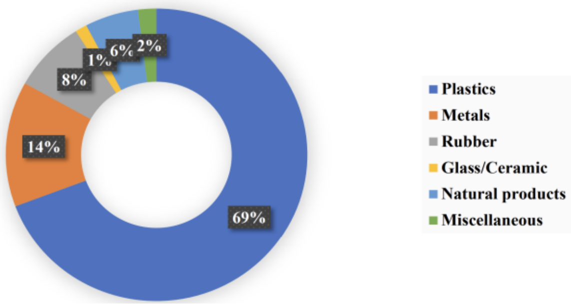


Figure 7. Composition by number of litter at La, Ghana

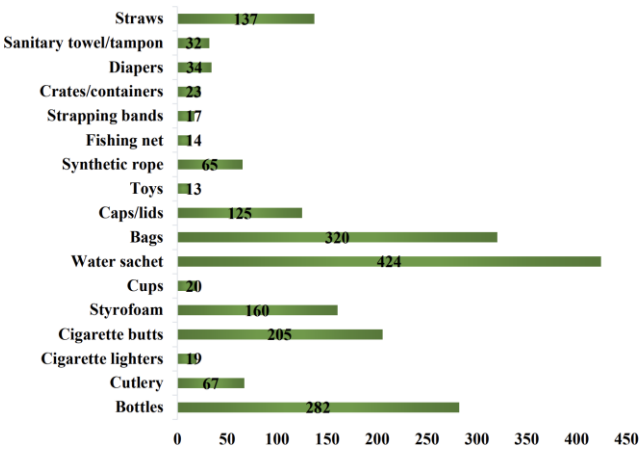


Figure 8. The abundance of the most dominant litter type (Plastics)

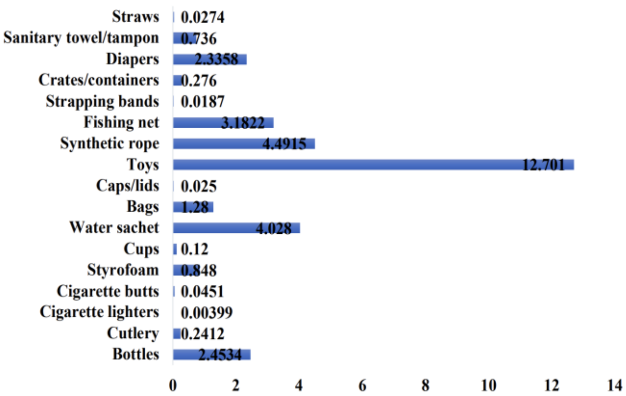


Figure 9. Weights of most dominant litter types

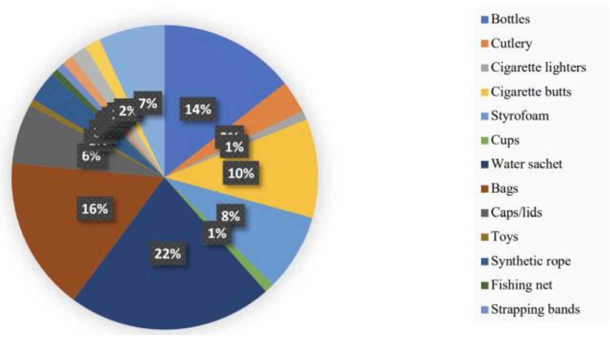


Figure 10. Percentage by number of plastics at both beaches

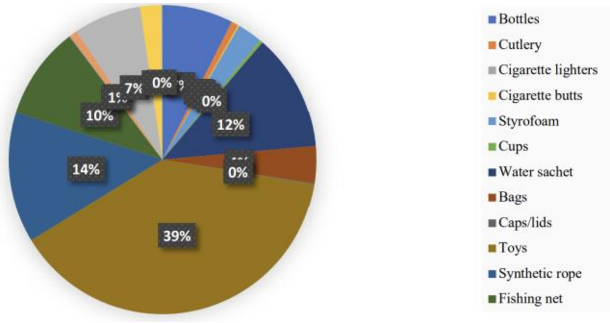


Figure 11. Percentage by weight of plastics from both beaches

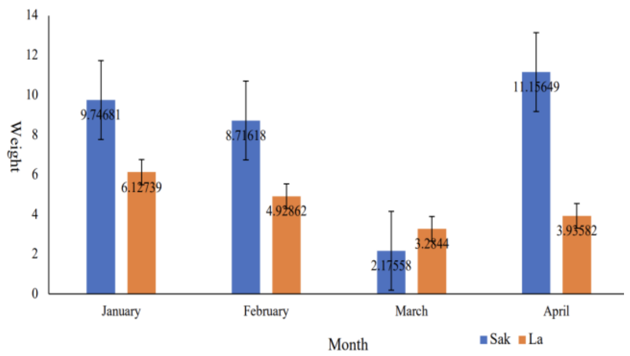


Figure 12. Monthly variation by weight

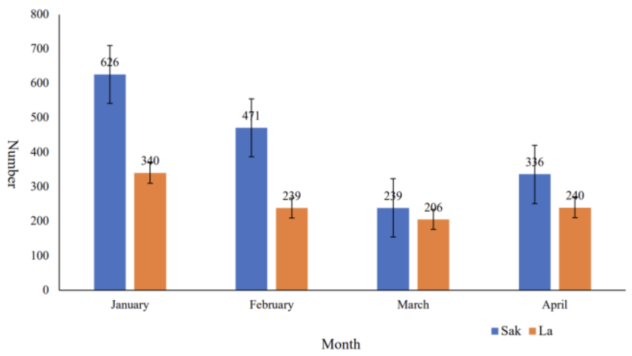


Figure 13. Monthly variation by number

Table 5. ANOVA Table for spatial variation in the amount of litter at Sakumono and La Pleasure Beaches, Ghana

Source of variation	SS	df	MS	F	P-value	F crit
Between Groups	52326.125	1	52326.125	9.0298544	0.02385469	5.98737761
Within Groups	34768.75	6	5794.79167			
Total	87094.875	7				

The weight and quantity of trash at the two beaches decreased over the survey's four months (Figures 12 and 13). However, this pattern changed in the fourth month, which was April. Over the previous month, there was an overall increase. However, Sakumono Beach recorded the highest weight in April (Figure 12). The survey as a whole gave this the highest weight. A total of 11.16 kg of litter was gathered at Sakumono Beach in April, accounting for about 22% of the total litter gathered throughout the survey (Figure 12). The litter with the smallest weight was found in March. This occurred at Sakumono Beach (Figure 13).

The density of trash at Sakumono and La Pleasure Beaches was 0.418 items/m^2 and 0.256 items/m^2, with monthly averages of 418 and 256 items, respectively. There was a p-value of 0.02 when using an ANOVA with a 95% confidence level (Table 5).

Discussion

Types and quantities of marine litter

A total of 2,697 pieces of marine debris totaling 50.0713 kg were gathered for this study. This number was lower than Van Dyck et al. (2016), 18.241 and 297.59 kg total. The sheer volume of beaches surveyed might explain this disparity. Four beaches were surveyed for that particular study (Sakumono, Mensah Guinea, La Pleasure, and Korle Gonno). The beaches at Sakumono and La Pleasure were the only two to receive surveys for this study. The length of the study may have also contributed to the variation in litter amounts. In contrast to Van Dyck et al. (2016), who conducted their study over sixteen weeks, the current study took place over eight weeks. The methodology employed may also supporting for the weight difference. Moreover, to determine the current study's actual weight as accurately as possible, the litter was air-dried and removed as much sand as possible. Unfortunately, the study did not go into detail about this. Both the current study and the one were carried out within 1,000 m2 transects, but in the current study, each survey was carried out by randomly selecting a transect, ensuring that every portion of the entire shoreline had an equal chance of being surveyed.

During the sampling, various litter items were discovered and gathered from the beaches, with drinking water sachets being the most prevalent. People's faith in the water from their home faucets appears to have declined over time. The fact that people are generally aware of how polluted the water bodies that supply the water that flows through our faucets may be the cause. Given the perception that sachet water is purer than water from the faucets, trust has been placed in it. However, not every home has running water, so people turn to sachet water for any needs. This increase in demand for sachet water has also resulted in the emergence of numerous sachet water manufacturing factories and, as a result, an increase in the number of water sachets, particularly in urban areas. Then came plastic bottles, then plastic bags, and drinking water sachets. This pattern resembles the most typical things gathered during numerous shorelines and/or underwater clean-up operations. The International Coastal Clean-up report (International Ocean Conservancy 2009) lists some items as plastic bags, plastic beverage bottles, food wrappers/containers, cigarettes, or cigarette filters.

In this study, it was discovered that plastics were the most prevalent and plentiful kind of litter. This result is comparable to other surveys conducted on beaches in South Africa (STAP 2011b) and a few other carefully chosen European beaches (OSPAR 2007). The percentages of plastics found at the Sakumono and La Pleasure Beaches (66% by weight and 73% by number) also favorably contrast with those found by Van Dyck et al. (2016). This supports the claim that, globally, plastics account for 60 to 80% of all marine litter collected (Derraik 2002; STAP (2011a). The nature of anthropogenic wastes has changed significantly over the last 30 to 40 years due to the introduction of plastics and synthetic materials in recent decades (Sheavly 2005).

Plastics, in general, are strong materials that resist natural biodegradation. As a result, when plastic enters the marine environment, it does not readily and easily degrade; rather, it is only torn into pieces by abrasion against rocks and other hard surfaces as well as by wave action (Allsopp et al. 2006). Since plastics are light and float when they enter the marine environment, they can travel great distances on currents and are dispersed widely throughout the oceans (Derraik 2002; Sheavly 2005). The litter weights, which were recorded, reflect the lightness of the plastic products. Water sachets were the most numerous but among the lightest items in terms of weight due to their thickness.

Ghanaian beaches are still littered with plastic waste. That demonstrates the pervasive use of plastics in daily tasks like product packaging and the eventual improper disposal of these plastic items. According to reports, cigarette butts are one of the primary sources of marine debris on beaches in Brazil, Spain, and the US (Slavin 2011). The current study revealed a comparable pattern. Cigarette butts were the fourth most abundant item after plastic bottles, water sachets, and bags, which clearly indicated this. That suggests the beaches receive a lot of recreational traffic and are popular smoking spots. That further indicates how many people who visit the beaches are a smoker.

Sources of litter identified

According to this study, 25 of the 35 litter items gathered during the survey were land-based (Table 4). That is consistent with the claim made in the literature that roughly 80% of the types of litter found on beaches come from land-based sources (GESAMP 1991; NOAA 2007a,b; Sheavly 2007; World Ocean Review 2010; USEPA 2012). This also fits with research done on the Hawaiian Islands and the West Coast of the United States of America (Sheavly 2007). The beach's location, ease of access, popularity as a tourist destination, and human behavior are all possible explanations for the high amount of land-based litter observed. A contributing factor to the large amounts of land-based litter may be the beach's proximity to inland inflow. That might cause inland waste to flow to the beach through rivers and lagoons. Again, based on the findings of Gregory and Ryan (1997), ocean-based litter accounted for the least amount of litter in origin, supporting the least amount of ocean-based litter recorded for this study. This area has few significant shipping routes because Tema is home to the only significant port, which may account for the low levels of ocean-based litter.

The spatial and temporal abundance of marine litter

By weight and count, Sakumono Beach typically had the most litter, followed by La Pleasure Beach. This pattern may be explained by the open nature of Sakumono Beach, primarily frequented by locals who are either tourists or partygoers and everyone who does not have to pay for entry. Additionally, there are no restrictions on what revelers can bring onto the beach; anything is allowed. Additionally, Sakumono Beach has only rudimentary waste management. Contrarily, entry to the managed La Pleasure Beach is controlled. Nearly every week, tourists from other countries visit this beach. Regarding waste management, La Pleasure Beach is also run better. The beach vendors clean their respective sections, but the establishment's management oversees general cleaning.

The amount of litter surveyed at both beaches yielded a p-value of 0.02 at an alpha value of 0.05. That suggests the amounts of trash found at the two beaches are noticeably different. According to the analysis, Sakumono Beach was more polluted than La Pleasure Beach. The statistical analysis backs up the observation and demonstrates how La Pleasure Beach has been managed. This contrasts favorably with the survey conducted by Van Dyck et al. (2016); Sakumono Beach had more trash than La Pleasure Beach.

Sakumono recorded a higher amount of litter by count but a lower amount by weight in March. This phenomenon may be explained by the fact that this month has less litter than the others. In the first week of March, for instance, more condoms and crown corks were counted than in any other week of the month. On 7 March, the day following the 6 March holiday, a survey for that week was also conducted. Due to the celebratory activities, particularly during the first week, more trash was anticipated to accumulate at the two beaches in March. But that wasn't the case. The following month saw more of a rise. That may result from human activity leaving trash on the beach and the effect of currents moving the trash from other locations to the beach. Every day, the tides rise and fall, moving the objects carried by the currents off the shore onto the shore as they do so. At Sakumono, the litter weight was highest in April and lowest in March.

Over the eight weeks, there was generally a decline in the litter trend, which may have been due to frequent beach clean-ups. However, Sakumono Beach, and the first month had the highest litter levels. This observation may be explained by the fact that celebrations and festivities continued from December (the Christmas season) through January (the New Year's celebrations).

In conclusion, plastics were the most prevalent litter at both beaches, especially drinking water sachets, followed by plastic bottles and bags. This shows the widespread use of plastics in everyday activities like packaging goods and the eventual improper disposal of these plastic items. On the other hand, in terms of quantity, most of the litter examined was made of plastic. Marine litter from land-based sources was the most prevalent during the survey, which is also suggestive of the fact that the majority of the litter generated is from activities in inland and coastal areas. From January to March, the litter collection showed a general decline over the weeks and then a sharp uptick in April. However, according to this survey, Sakumono Beach was dirtier than La Pleasure Beach. From this study, it can be inferred that La Pleasure Beach is less polluted than Sakumono Beach, with 18.28 kg of weight and 1,025 litter items compared to Sakumono Beach's 31.80 kg of weight and 1,672 litter items. That may be because La Pleasure Beach is managed and efforts are made to lessen litter on the beach.

REFERENCES

Allsopp M, Walters A, Santillo D. Johnston P. 2006. Plastic Debris in the World's Oceans. Greenpeace Research.

Amlalo DS. 2007. The Protection, Management and Development of the Marine and Coastal Environment of Ghana. http://www.fig.net/pub/figpub/pub36/chapters/chapter_10.pdf [Accessed 3 March 2019].

Barr C. 2000. Marine Debris Monitoring and Data Collection Activities Conducted by the Center for Marine Conservation. Paper from the International Marine Debris Conference on Derelict Fishing Gear and the Ocean Environment, Honolulu, HI, 935- 962.

CMC. 2000. Pocket Guide to Marine Debris. Center for Marine Conservation, Washington, DC, USA.

Derraik JGB. 2002. The pollution of the marine environment by plastic debris: A review. Mar Pollut Bull 44: 842-852. DOI: 10.1016/S0025-326X(02)00220-5.

EPA. 2012. Manual for the preparation of District Waste Management Plans. Environmental Protection Agency.

Galgani F, Hanke G, Werner S, Oosterbaan L, Nilsson P, Fleet D, Kinsey S, Thompson RC, Van Franeker J, Vlachogianni T, Scoullos M, Mira Veiga J, Palatinus A, Matiddi M, Maes T, Korpinen S, Budziak A, Leslie H, Gago J, Liebezeit G. 2013. Guidance on Monitoring of Marine Litter in European Seas. MSFD Technical Subgroup on Marine Litter (TSG-ML).

Galgani FD, Fleet J, Van Franeker S, Katsanevakis T, Maes J, Mouat L, Oosterbaan I, Poitou G, Hanke R, Thompson E, Amato A, Birkun, C Janssen. 2010. Marine strategy framework directive, task group 10 report: Marine litter. In: Zampoukas N (eds). JRC Scientific and Technical Reports. European Commission Joint Research Centre, Ispra.

Ghana Statistical Service (GSS). 2014. 2010 population and housing census report. Ghana Statistical Service, Ghana.

Gregory MR, Andrady AL. 2003. Plastics in the marine environment. In: Andrady AL (eds). Plastics and the Environment. John Wiley and Sons, Inc., New York. DOI: 10.1002/0471721557.

Gregory MR, Ryan PG. 1997. Pelagic plastics and other seaborne persistent synthetic debris: A review of Southern Hemisphere perspectives. Prepared for AB 259 (Krekorian), AB 820 (Karnette), and AB 904 (Feuer) by the Algalita Marine Research Foundation. DOI: 10.1007/978-1-4613-8486-1_6.

Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP). 1991. The State of the Marine Environment. Blackwell Scientific Publications, London.

Hoagland P, Kitte-Powell HL. 1997. Characterization and mitigation of marine debris in the Gulf of Maine. A report prepared for the US Gulf of Maine Association. Contract No. GM 97-13. Woods Hole Research Consortium.

International Ocean Conservancy. 2009. A Rising Tide of Ocean Debris and What We Can Do About It. International Coastal Clean-up Results 2008. The Ocean Conservancy.

Ivar do Sul JA, Costa MF. 2007. Marine debris review for Latin America and the Wider Caribbean Region: From the 1970s until now, and where do we go from here? Mar Pollut Bull 54: 1087-1104. DOI: 10.1016/j.marpolbul.2007.05.004.

Jambeck J, Timothy GT, Barr CG. 2001. A Survey of Marine Debris Management and Research. [Accessed 17 July 2012] http://www.crrc.unh.edu/marine-debris/awma_paper.pdf

Jambeck JR, Geyer R, Wilcox C, Siegler TR, Perryman M, Andrady A, Narayan R, Law KL. 2015. Plastic waste inputs from land into the ocean. Science 347: 768-771. DOI: 10.1126/science.1260352.

Lakshmi A, Rajagopalan R. 2000. Socio-economic implications of coastal zone degradation and their mitigation: A case study from coastal villages in India. Ocean Coast Manag 43: 749-762. DOI: 10.1016/S0964-5691(00)00057-0.

Lie S, Suyoko A, Effendi AR, Ahmada B, Aditya HW, Sallima IR, Arisudewi NPAN, Hadid NI, Rahmasari N, Reza A. 2018. Measurement of microplastic density in the Karimunjawa National Park, Central Java, Indonesia. Ocean Life 2: 54-58. DOI: 10.13057/oceanlife/o020204.

Masalu DC. 2000. Coastal and marine resource use conflicts and sustainable development in Tanzania. Ocean Coast Manag 43 (6): 475-494. DOI: 10.1016/S0964-5691(00)00039-9.

Mouat J, Lozano LR, Bateson H. 2010. Economic Impacts of Marine Litter, pp. 117: KIMO (Kommunenes Internasjonale Miljøorganisasjon).

National Oceanic and Atmospheric Administration (NOAA). 2007a. Marine Debris [online]. Available at :< URL: http://marinedebris.noaa.gov/whatis/welcome.html> [Accessed 5 May 2019].

National Oceanic and Atmospheric Administration (NOAA). 2007b. Marine Debris 101: Land-Based Sources of Marine Debris, Fishing Facts, Boating Facts.

National Oceanic and Atmospheric Administration (NOAA). 2010. 2008-2009 Progress Report on the Implementation of the Marine Debris Research, Prevention, and Reduction Act. Silver Spring, MD.

Nunoo FKE, Quayson E. 2003. Towards management of litter accumulation – case study of two beaches in Accra, Ghana. J Ghana Sci Assoc 5 (1): 145-155.

Opfer S, Arthur C, Lippiatt S. 2012. NOAA Marine Debris Shoreline Survey Field Guide. National Oceanic and Atmospheric Administration Office of Response & Restoration Marine Debris Program Silver Spring, MD.

Rockefeller D. 2003. Oceans Away [Online]. Available at :< URL: http://www.populationeducation.org/docs/earthmatters/reading-oceans_away.pdf> [Accessed 12 February 2019]

Sheavly SB. 2005. Sixth Meeting of the UN Open-ended Informal Consultative Processes on Oceans & the Law of the Sea. Marine Debris – An Overview of a Critical Issue for Our Oceans. June 6-10, 2005. New York.

Sheavly SB. 2007. National Marine Debris Monitoring Program: Final Program Report, Data Analysis and Summary. Prepared for US Environmental Protection Agency by Ocean Conservancy, Grant Number X83053401-02.

Slavin MC. 2011. Types and Sources of Marine Debris in Northern Tasmania. [BSc. Thesis]. University of Australia, Hobart.

STAP. 2011a. Marine Debris as a Global Environmental Problem: Introducing a Solutions - based Framework Focused on Plastic. A

STAP Information Document. Global Environment Facility, Washington, DC.
STAP. 2011b. Marine Debris: Defining a Global Environmental Challenge. A STAP Information Document. Global Environment Facility, Washington, DC.
Thompson R, Moore C, Andrady A, Gregory M, Takada H, Weisberg S. 2005. New directions in plastic debris. Science 310: 11-17. DOI: 10.1126/science.310.5751.1117b.
Thompson RC, Moore CJ, von Saal FS, Swan SG. 2009. Plastics, the environment and human health: Current consensus and future trends. Philos Trans R Soc Lond B Biol Sci 364: 2153-2166. DOI: 10.1098/rstb.2009.0053.
Topping P, Eade A, Eaton P. 1994. Marine plastic debris research in Canada. Paper presented at the 3rd International Conference on marine debris, Miami, Florida, May 1994. Marine Environment Division, Canada.
Tsagbey SA, Mensah AM, Nunoo FKE. 2009. Influence of tourist pressure on beach litter and microbial quality: Case study of two beach resorts in Ghana. West Afr J Appl Ecol 15: 13-23. DOI: 10.4314/wajae.v15i1.49423.
UNEP. 1990. The Problem of Persistent Plastics and Marine Debris in the Oceans. UNEP Regional Seas Reports and Studies No. 114.
UNEP. 2009. Marine Litter: A Global Challenge. UNEP, Nairobi.
UNEP. 2016. Marine Plastic Debris and Microplastics – Global Lessons and Research to Inspire Action and Guide Policy Change. United Nations Environment Programme, Nairobi.
USEPA. 2012. Water: Marine Debris. Environmental Protection Agency, Office of Water, Washington, DC.
Van Dyck IP, Nunoo FKE, Lawson ET. 2016. An empirical assessment of marine debris, seawater quality and littering in Ghana. J Geosci Environ Prot 4: 21-36. DOI: 10.4236/gep.2016.45003.
World Ocean Review. 2010. Living with the Oceans. Maribus gGmbH, Pickhuben, Hamburg.